



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(s): Ede  
SERIAL NO.: 10/722,961 ART UNIT: 2111  
FILED: November 26, 2003 EXAMINER:  
TITLE: Interface for Serial Data Communication  
ATTORNEY DOCKET NO.: 884A.0026.U1(US)

Commissioner For Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

Transmittal Of Certified Copy

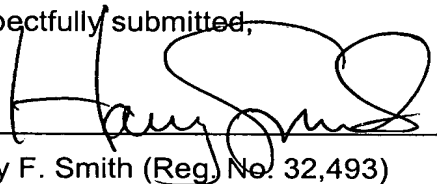
Sir:

Applicant(s) claim the benefit of the following prior foreign patent application under 35 U.S.C. §119 for the above-identified U.S. patent application:

Country: United Kingdom  
Application No.: 0327216.8  
Filing Date: November 22, 2003

Attached is a certified copy of the foreign application from which priority is claimed.

Respectfully submitted,

  
Harry F. Smith (Reg. No. 32,493)

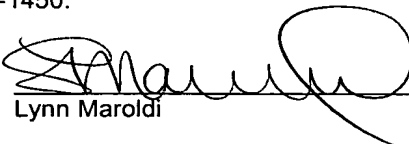
3/17/2004  
Date

**Customer No.: 29683**  
Harrington & Smith, LLP  
4 Research Drive  
Shelton, CT 06484-6212  
203-925-9400

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail on the date shown below in an envelope addressed to: Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450.

3/17/2004  
Date

  
Lynn Maroldi





INVESTOR IN PEOPLE

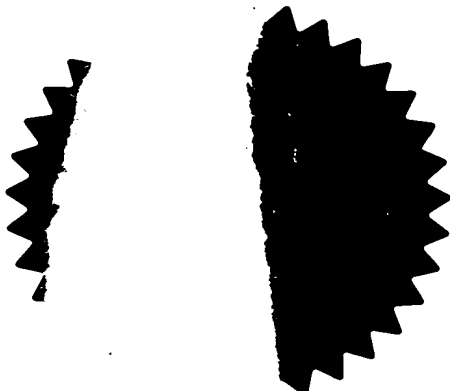
The Patent Office  
Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

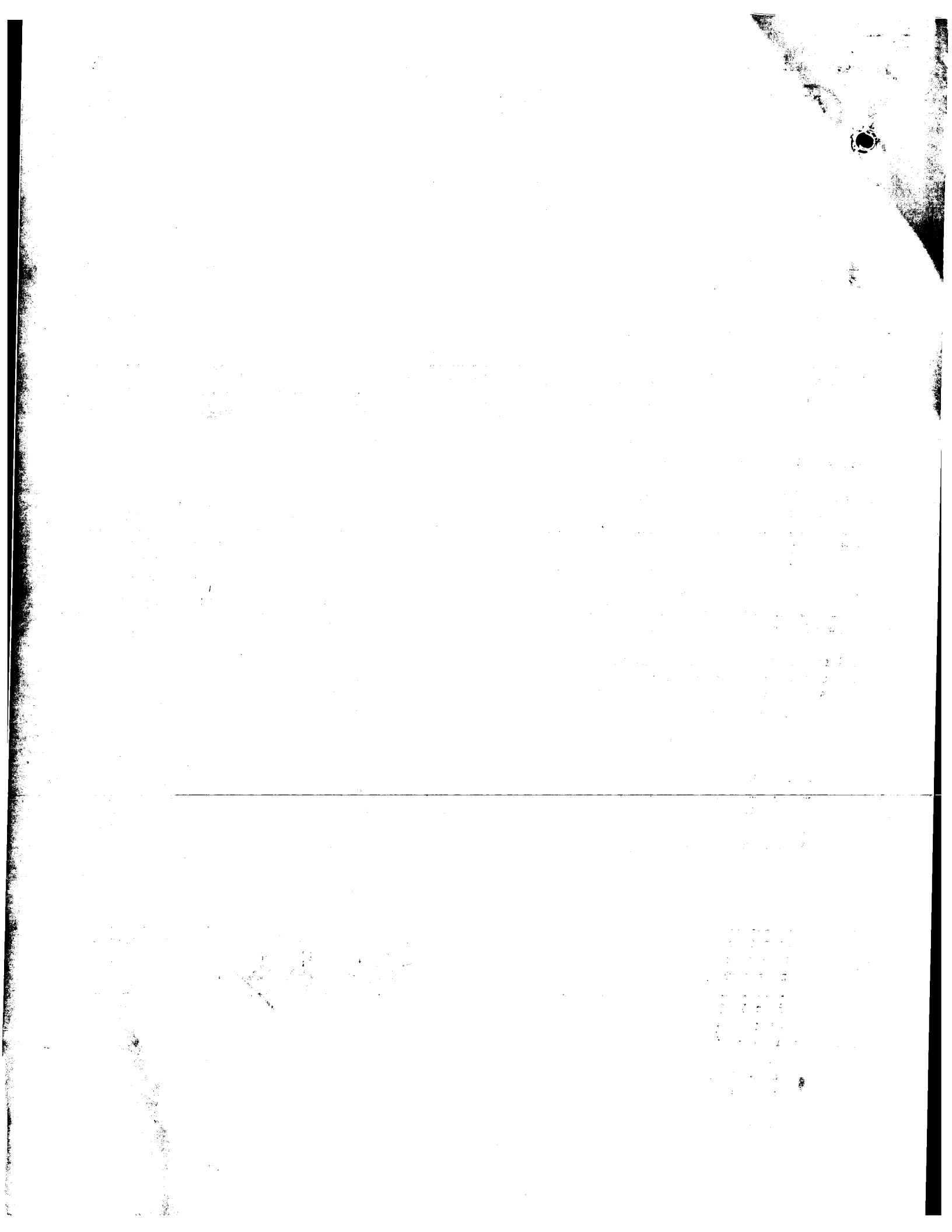
In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

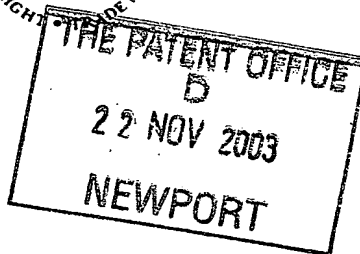
In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed *Stephen Hordley*  
Dated 11 December 2003





24NOV03 EB54295-4 D02833  
P01/7700 0.00-0327216.8

22 NOV 2003

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference

PH/8583UK

2. Patent application number

(The Patent Office will fill this part in)

0327216.8

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Nokia Corporation,  
Keilalahdentie 4, FIN-02150,  
Espoo, Finland

Patents ADP number (if you know it)

07652217001

If the applicant is a corporate body, give the country/state of its incorporation

Finland

4. Title of the invention

An interface for serial data communication

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Swindell & Pearson

48 Friar Gate  
Derby  
DE1 1GY

Patents ADP number (if you know it)

00001578001 ✓

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application

Date of filing  
(day / month / year)

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Yes

Answer YES if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

# Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	0
Description	12
Claim(s)	5
Abstract	1
Drawing(s)	1

10. If you are also filing any of the following, state how many against each item.

## Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for a preliminary examination and search (Patents Form 9/77)

Request for a substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature(s)

Swindell & Pearson

Date 21st November 2001

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

Paul Higgin - 01332 367051

## Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

## Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

## TITLE

An interface for serial data communication.

## TECHNICAL FIELD

- 5 Embodiments of the invention relate to an interface for serial data communication. In particular, embodiments relate to a Universal Serial Bus (USB) interface.

## BACKGROUND OF THE INVENTION

- 10 The Universal serial bus (USB) is a cable bus that supports data exchange between a host and a wide range of simultaneously accessible peripherals. The attached peripherals share USB bandwidth through a host-scheduled, token-base protocol.
- 15 The USB system transfers data in bit serial format between the USB host and the USB peripheral. There is only one host in a USB system and it is master of the bus. The USB is a polled bus and the Host initiates all data transfers which are either a read from or a write to an endpoint.
- 20 In USB the role of host and peripheral is defined by which end of the cable a device is connected. If a device has an A receptacle for connection to an A-plug of the cable it is an A-device and if it has a B receptacle for connection to a B-plug it is a B-device. In USB an A-device provides power via a power contact Vbus to the B-device. The A-device is always the host and the B-
- 25 device is always the peripheral.

- The USB On-The-Go (OTG) supplement to USB allows a device to be dual mode. A dual mode device has a mini A/B connector that allows it to be connected to a mini A-plug as an A-device or to be connected to a mini B-plug
- 30 as a B-device. As a default a dual mode device when connected as an A-device operates as a default host and when connected as a B-device operates as a default peripheral. However, OTG will enable the role of the

dual-role device to change without reversing the cable. Thus the OTG device will be able to operate as a host or peripheral whether to is connected as an A-device or a B-device.

- 5 On the Go will also provide power saving features. In order to conserve power, OTG will allow an A-device to leave Vbus turned off when the serial bus is not being used.

10 However, turning off Vbus has, as yet, unappreciated disadvantages. In the absence of Vbus it is not possible for one device to detect automatically whether it has become connected to a device, or it is still connected to another device, or it is now connected to a different device. It would be desirable to maintain lower power consumption but enable automatic detection.

15

#### BRIEF SUMMARY OF THE INVENTION

20 According to one aspect of the present invention there is provided an interface connectable as a default host to a peripheral or as a default peripheral to a host, for serial data communication between host and peripheral during a session, and comprising: automated means for periodically checking a connection by periodically starting a session when connected as a default host and automated means for periodically checking a connection by periodically requesting a session when connected as a default peripheral.

25

30 According to another aspect of the present invention there is provided an interface, for serial data communication between a host and a peripheral, connectable as a default host or a default peripheral and comprising: a power signal contact; at least one data signal contact; transmission means for repeatedly sending a poll signal via the power signal contact; and reception means for receiving a reply signal via the power signal contact, if the device is connected as a default peripheral and the data signal contact if the device is



connected as a default host.

5 According to another aspect of the present invention there is provided a host interface, for serial data communication between a host and a connected peripheral during a session: a power signal contact for supplying power to the connected peripheral; at least one data signal contact for serially communicating data between the host and connected peripheral; and means for periodically checking the connection to the peripheral comprising:  
10 transmission means for repeatedly sending a poll signal via the power signal contact; and reception means for receiving a reply signal via the data signal contact.

15 According to another aspect of the present invention there is provided a peripheral interface, for serial data communication between a connected host and a peripheral during a session: a power signal contact for receiving power from the connected host; at least one data signal contact for serially communicating data between the connected host and peripheral; and means for periodically checking the connection to the host comprising: transmission  
20 means for repeatedly sending a first poll signal via the power signal contact and for repeatedly sending a second poll signal via the data signal contact; and reception means for receiving a reply signal via the power signal contact.

25 According to another aspect of the present invention there is provided a method of checking a serial data connection between a device connected as host and a device connected as a peripheral, comprising: periodically starting a session at the device connected as host.

30 According to another aspect of the present invention there is provided a method of checking a serial data connection between a device connected as host and a device connected as a peripheral, comprising: periodically requesting the start of a session at the device connected as a peripheral.

According to another aspect of the present invention there is provided a method of checking a serial data connection between a dual mode device and another device, comprising: periodically starting a session at the device  
5 connected as host when the dual mode device is connected as a default host; and periodically requesting the start of a session at the device connected as a peripheral when the dual-mode device is connected a as a default peripheral.

The term 'poll' in this document means to repeatedly check. Thus a 'poll  
10 signal' is a signal that is used to repeatedly check whether a device is connected/disconnected.

Embodiments of the invention enable power saving and the automatic  
15 detection of connection/disconnection of a USB device without user intervention.

#### BRIEF DESCRIPTION OF DRAWINGS

For a better understanding of the present invention reference will now be made by way of example only to the accompanying drawings in which:

20 Fig. 1 illustrates a Universal Serial Bus (USB) system according to one embodiment; and

Fig. 2 illustrates a Universal Serial Bus (USB) system according to one embodiment.

#### 25 DETAILED DESCRIPTION OF EMBODIMENT(S) OF THE INVENTION

Fig. 1 illustrates a Universal Serial Bus (USB) system 1 comprising a first USB device 2 connected to a second device 4 using a cable 6.

30 The first USB device 2 is, in this example, a dual-mode device and has an interface 12 including a A/B mini receptacle (not shown). The A/B receptacle receives a mini A-plug 7 at one end of the cable 6. The interface 12 may

therefore be referred to as an A/B interface but it operates, when connected as shown, as an A-interface or host interface.

5 The second USB device 4 is, in this example, a peripheral device and has an interface 22 including a mini B receptacle (not shown). The mini B receptacle receives a mini B-plug 8 at the other end of the cable 6. The interface 12 may therefore be referred to as a B-interface or peripheral interface.

10 Although a cable 6 is illustrated it should be appreciated that adapters, dongles or the like may be connected directly to the A-interface 12 without a cable. Although a mini A-plug to mini B-plug cable is illustrated, in other examples such as when the receptacle of the B-interface 22 has a standard B receptacle a mini A-plug to standard B-plug cable may be used.

15 The A/B interface 12 of the dual-mode device 2 comprises a USB transceiver 14 and five pin contacts. The first pin contact 40 (Vbus) is used to provide power from the A-device to the B-device. The second pin contact 42 (D+) and the third pin contact 44 (D-) are used as differential data lines for transmitting data between connected devices. The fourth pin contact 46 (GND) is used as  
20 an earth or ground. The fifth pin contact 48 (ID) is used to detect, in the dual mode device 2, whether it is connected to a mini A-plug or a mini B-plug. A mini A-plug connects, when inserted, the fourth pin contact 46 (ID) to the fifth pin contact (GND) via a resistor. A mini B-plug, when inserted, leaves the fourth pin contact 46 (ID) isolated.

25

The first pin contact 40 is connectable to a 5V voltage supply via a controllable switch 16. The switch is controlled by the USB transceiver 14.

30 The A/B interface 12 is capable of detecting automatically, without user intervention, a device connected to it by periodically polling Vbus. The USB transceiver 14 repeatedly sends a poll signal via the first contact pin 40. The poll signals are sent periodically as a train of voltage pulses that have a

constant interval between them. In alternative embodiments the interval may vary.

5 The USB transceiver 14 achieves this using the controllable switch 16 by periodically switching power on at the first pin contact 40 and then switching power off. The period between the successive occasions on which the USB transceiver 14 switches power on is of the order one second. However, this period may be varied. The duration for which the power is switched on is at least 200ms but preferably of the order 200ms. The duration is dependent  
10 upon the acceptable delay in responding to device connection/disconnection/reconnection.

The B-interface 22 monitors Vbus and when the voltage on the line exceeds a predetermined threshold, a pull-up resistor 24 is connected to one of the data  
15 lines D+, D-. This is not described in detail as this is how a current peripheral USB device responds to a host initiating a session by switching and keeping Vbus on. If the B-interface 22 is a high speed interface then the pull-up resistor is connected to the data line D+ using a switch. If the B-interface 22 is a low speed interface then the pull-up resistor is connected to the data line D-  
20 using a switch.

The A/B-interface 12 monitors the second pin contact 42 and the third pin contact 44 and detects when a pull-up transistor 24 is connected to the second pin contact (D+) or the third pin contact (D-). Enumeration may then  
25 occur. This is the process described in the USB specifications by which the second device 4 is allocated an address and data is sent from the second device 4 to the default host device 2 that identifies the capabilities of the second device and enables communications between the first device 2 and the second device 4.

30 The first device 2 may comprise, in addition to A/B-interface 12, a controller 30, a keypad 32 and a display 34. The controller 30 is connected to provide

outputs to the display 34 and the A/B interface 12 and to receive inputs from the keypad 32 and the USB transceiver 14 of the A/B interface 12.

5 The USB transceiver 14 provides a detection signal to the controller 30 when a pull-up resistor 24 is detected from one of the data pin contacts 42, 44. The USB transceiver 14 also provides an indication of the capabilities of the connected second device 4 following enumeration to the controller 30.

10 The controller 30 may consequently control the display 34 to indicate when a device is connected or disconnected from A/B-interface 12. If a device is newly connected the controller 30 may automatically start a related application or display an identification of the device on the display 34.

15 The opening and closing of the switch 16 may be controlled by the software of the controller 30. The software would control the periodic polling of Vbus and the monitoring of the data lines for a response.

20 Another solution is to provide additionally hardware (not shown) that controls the periodic opening and closing of the switch 16. The hardware would be initiated by the controller 30. The hardware then periodically polls on Vbus at a rate specified by the controller 30. The USB transceiver can, after initiating the hardware, enter a sleep mode while the hardware manages auto-detection of (dis)connection. The hardware monitor the data lines D for a response to a poll signal on Vbus and when a response is detected it sends  
25 an interrupt to the controller 30 to wake it from its sleep mode. This allows the controller 30 to remain in a sleep state for longer, saving power.

30 The periodic polling on Vbus may be initiated when the USB transceiver detects that a plug has been connected to the A/B interface 12 and a data communication session is not occurring.

The period with which poll signals are sent may be programmed. A longer

period saves power but may result in an undesirable delay between a user attaching a plug to the A/B interface 12 and observing a reaction from the first device 2. A short period makes the first device 2 appear responsive when a device is connected or disconnected but uses more power. A value between 1  
5 to 2 seconds is a good compromise.

In summary, the USB transceiver 14 therefore removes power from Vbus to save energy when a data communication session is no longer required. However, in the absence of power on Vbus it is not possible to determine if a  
10 new device is connected or a device is disconnected. Therefore, the USB transceiver 14 periodically checks a connection by periodically starting a session, i.e. it periodically sends a poll signal as described above.

Fig. 2 illustrates a Universal Serial Bus (USB) system 101 comprising a first  
15 USB device 102 connected to a second device 104 using a cable 106.

The first USB device 102 is, in this example, a dual-mode device and has an interface 112 including a A/B mini receptacle (not shown). The A/B receptacle receives a mini B-plug 108 at one end of the cable 106. The interface 112  
20 may therefore be referred to as an A/B interface but it operates, when connected as shown, as a B-interface or default peripheral interface.

The second USB device 104 is, in this example, another dual-mode device and has an interface 122 including a mini AB receptacle (not shown). The mini  
25 AB receptacle receives a mini A-plug 107 at the other end of the cable 106. The interface 122 may therefore be referred to as an A-interface or default host interface.

Although a cable 106 is illustrated it should be appreciated that adapters,  
30 dongles or the like may be connected directly to the A/B-interface 122 without a cable.

The A/B interface 112 of the first dual-mode device 2 comprises a USB transceiver 114 and five pin contacts. The first pin contact 140 (Vbus) is used to provide power from the A-device to the B-device. The second pin contact 142 (D+) and the third pin contact 144 (D-) are used as differential data lines for transmitting data between connected devices. The fourth pin contact 146 (GND) is used as an earth or ground. The fifth pin contact 148 (ID) is used to detect, in the first dual mode device 102, whether it is connected to a mini A-plug or a mini B-plug. A mini A-plug connects, when inserted, the fifth pin contact 148 (ID) to the fourth pin contact 146 (GND) via a resistor. A mini B-plug, when inserted, leaves the fifth pin contact 148 (ID) isolated.

The first pin contact 140 (Vbus) is connectable to a 3.3V voltage supply via a controllable switch 115 and a resistor 116. The switch 115 is controlled by the USB transceiver 114.

The second pin contact 142 (D+) is connectable to a 3.3V voltage supply via a controllable switch 117 and a resistor 118. The switch 117 is controlled by the USB transceiver 114.

The A/B interface 112 is capable of detecting automatically, without user intervention, a device connected to it by periodically requesting the second (host) device 104 to start a session using the Session Request Protocol (SRP).

The SRP is defined in the OTG supplement. The USB transceiver 14 turns on the switch 117 to connect D+ to the pull-up resistor 118, it then turns off the switch 117 to disconnect D+ to the pull-up resistor 118, it then turns on the switch 115 to connect Vbus to the pull-up resistor 116 and then turns off the switch 115 to disconnect Vbus to the pull-up resistor 116. This sequence of alternately pulsing D+, then Vbus lasts for less than 100ms and is repeated periodically. This period is of the order one second. However, it may be

varied.

The USB transceiver 114 monitors the state of Vbus via the first pin contact 140, as an attached host interface 122 responds to SRP by turning Vbus on  
5 i.e. applying a voltage to it.

The operational modes of the first and second devices may be switched using the Host Negotiation Protocol (HNP) specified by the OTG supplement. This allows the first dual mode device to operate as host and the second dual  
10 mode device 104 to operate as a peripheral. Enumeration may then occur. This is the process described in the USB specifications by which the peripheral device 104 is allocated an address and data is sent from it to the host device 102 that identifies the capabilities of the second device 104 and enables communications between the first device 102 and the second device  
15 104.

The first dual mode device 102 may comprise, in addition to the A/B-interface 112, a controller 130, a keypad 132 and a display 134. The controller 130 is connected to provide outputs to the display 134 and the A/B interface 112 and  
20 to receive inputs from the keypad 132 and the USB transceiver 114 of the A/B interface 112.

The USB transceiver 114 provides a detection signal to the controller 130 when a constant voltage is sensed on the first pin contact 140 (Vbus). The  
25 USB transceiver 114 also provides an indication of the capabilities of the connected second device 104 following enumeration to the controller 130.

The controller 130 may consequently control the display 134 to indicate when a device is connected or disconnected from A/B-interface 112. If a device is  
30 newly connected the controller 130 may automatically start a related application or display an identification of the device on the display 134.



The opening and closing of the switches 115 and 117 may be controlled by the software of the controller 130. The software would control the periodic pulsing of Vbus and D+ and the monitoring of Vbus for a response. Another solution is to provide additional hardware (not shown) that controls the periodic opening and closing of the switches 115 and 117. The hardware would be initiated by the controller 130. The hardware then periodically pulses D+ then Vbus at a rate specified by the controller 130. The USB transceiver can, after initiating the hardware, enter a sleep mode while the hardware manages auto-detection of (dis)connection. The hardware monitors Vbus for a response to SRP and when a response is detected it sends an interrupt to the controller 130 to wake it from its sleep mode. This allows the USB controller 130 to remain in a sleep state for longer, saving power.

The periodic SRP (pulsing D+ then Vbus) may be initiated when the USB transceiver detects that a plug has been connected to the A/B interface 12 and a data communication session is not occurring.

The period with which SRP is initiated may be programmed. A longer period saves power but may result in an undesirable delay between a user attaching a plug to the A/B interface 12 and observing a reaction from the first device 2. A short period makes the first device 2 appear responsive when a device is connected or disconnected but uses more power. A value between 1 to 2 seconds is a good compromise.

In summary, the USB transceiver 14 periodically checks a connection by periodically requesting a session, i.e. it periodically pulses D+ and Vbus.

Any A-device, including a PC or laptop, is allowed to respond to SRP. Any B-device, including a standard USB peripheral, is allowed to initiate SRP. A dual-role device is required to be able to initiate and respond to SRP.

Although the embodiments of Figs 1 and 2 have been described separately, it

should be appreciated that is envisioned that a single dual mode device will have an A/B interface that provides the functionality of the A/B interface described with reference to Fig. 1 and the functionality of the A/B interface described with reference to Fig. 2. The functionality of Fig. 1 is used when the dual-mode device is connected as an A-device (default host) and the functionality of Fig. 2 is used when the dual-mode device is connected as a B-device (default peripheral).

Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the spirit and scope of the invention. For example, although the additional electronic circuitry provided for embodiments of this invention such as controllable switch 16 in Fig. 1 and resistors 116, 118 and switches 117, 115 in Fig. 2 are illustrated as separate from the USB transceiver, they may in other embodiments be integrated within the USB transceiver.

20

25

30

## CLAIMS

1. An interface connectable as a default host to a peripheral or as a default peripheral to a host, for serial data communication between host and peripheral during a session, and comprising:
  - 5 automated means for periodically checking a connection by periodically starting a session when connected as a default host and
  - automated means for periodically checking a connection by periodically requesting a session when connected as a default peripheral.
- 10 2. An interface as claimed in claim 1, wherein a session identifies the presence of a connected device.
3. An interface as claimed in claim 1 or 2, comprising:
  - 15 a power signal contact; and
  - at least one data signal contact;
  - wherein, when connected as a default host, the means for periodically checking a connection is operable to periodically apply a voltage to the power signal contact and receive a response via the data signal contact.
- 20 4. An interface as claimed in claim 1, 2 or 3, comprising a power signal contact; and at least one data signal contact; wherein, when connected as a default peripheral, the means for periodically checking a connection is operable to periodically request a session via the power signal contact and the data signal contact and receive a response via the power signal contact.
- 25 5. An interface as claimed in any preceding claim, wherein a session identifies the capabilities of a connected device.
- 30 6. An interface, for serial data communication between a host and a

peripheral, connectable as a default host or a default peripheral and comprising :

a power signal contact;

at least one data signal contact;

5 transmission means for repeatedly sending a poll signal via the power signal contact; and

reception means for receiving a reply signal via the power signal contact, if the device is connected as a default peripheral and the data signal contact if the device is connected as a default host.

10

7. An interface as claimed in claim 6, wherein the poll signals are sent periodically as a train of voltage pulses.

15 8. An interface as claimed in claim 7, wherein each pulse of the train has a duration greater than 200ms.

9. An interface as claimed in claim 7 or 8, the poll signals have a periodicity of the order of 1 Hz such that each pulse of the train is separated from its neighbour by the same duration of the order 1 second.

20

10. An interface as claimed in any one of claims 6 to 9, wherein the transmission means is operable to repeatedly send a poll signal only via the power signal contact if the device is connected as a default host.

25 11. An interface as claimed in any one of claims 6 to 10, wherein the transmission means is operable to repeatedly send both a first poll signal via the power signal contact and a second poll signal via the data signal contact, if the device is connected as a default peripheral.

30 12. An interface as claimed in any one of claims 6 to 11, further comprising an identifier contact for identifying whether the interface is connected to a peripheral or a host.

13. An interface as claimed in any one of claims 6 to 12, wherein the reply message identifies the presence of connected device.

5 14. An interface as claimed in any one of claims 6 to 13, wherein a session is started that identifies the capabilities of a connected device.

15. A host interface, for serial data communication between a host and a connected peripheral during a session:

10 a power signal contact for supplying power to the connected peripheral;  
at least one data signal contact for serially communicating data between the host and connected peripheral; and  
means for periodically checking the connection to the peripheral comprising:  
transmission means for repeatedly sending a poll signal via the power signal  
15 contact; and  
reception means for receiving a reply signal via the data signal contact.

16. A host interface as claimed in claim 15, arranged to periodically start a session on its own initiative or in response to periodic requests from the  
20 connected peripheral.

17. A peripheral interface, for serial data communication between a connected host and a peripheral during a session:

a power signal contact for receiving power from the connected host;  
25 at least one data signal contact for serially communicating data between the connected host and peripheral; and  
means for periodically checking the connection to the host comprising:  
transmission means for repeatedly sending a first poll signal via the power signal contact and for repeatedly sending a second poll signal via the data  
30 signal contact; and  
reception means for receiving a reply signal via the power signal contact.

18. A peripheral interface as claimed in claim 17, arranged to periodically request a session.

5 19. An interface as claimed in claim 18, wherein each request has a duration less than 100ms.

10 20. A method of checking a serial data connection between a device connected as host and a device connected as a peripheral, comprising:  
periodically starting a session at the device connected as host

21. A method of checking a serial data connection between a device connected as host and a device connected as a peripheral, comprising:  
periodically requesting the start of a session at the device connected as a peripheral.

15 22. A method of checking a serial data connection between a dual mode device and another device, comprising:  
periodically starting a session at the device connected as host when the dual mode device is connected as a default host; and  
20 periodically requesting the start of a session at the device connected as a peripheral when the dual-mode device is connected as a default peripheral.

25 23. An interface connectable as a default host to a peripheral or as a default peripheral to a host, for serial data communication between host and peripheral during a session, and comprising:  
a transceiver arranged to periodical checking a connection by periodically starting a session when connected as a default host and by periodically requesting a session when connected as a default peripheral.

30 24. An interface, for serial data communication between a host and a peripheral, connectable as a default host or a default peripheral and comprising :

a power signal contact;

at least one data signal contact; and

electronic circuitry for repeatedly sending a poll signal via the power signal contact and for receiving a reply signal via the power signal contact, if the

5 device is connected as a default peripheral and via the data signal contact if the device is connected as a default host.

**25.** A host interface, for serial data communication between a host and a connected peripheral during a session:

10 a power signal contact for supplying power to the connected peripheral;

at least one data signal contact for serially communicating data between the host and connected peripheral; and

electronic circuitry for periodically checking the connection to the peripheral, wherein the electronic circuitry is arranged to repeatedly send a poll signal via

15 the power signal contact and is arranged to receive a reply signal via the data signal contact.

**26.** A peripheral interface, for serial data communication between a connected host and a peripheral during a session:

20 a power signal contact for receiving power from the connected host;

at least one data signal contact for serially communicating data between the connected host and peripheral; and

a electronic circuitry for periodically checking the connection to the host, wherein the electronic circuitry is arranged to repeatedly send a first poll

25 signal via the power signal contact and to repeatedly send a second poll signal via the data signal contact and is arranged to receive a reply signal via the power signal contact.

## ABSTRACT

5 An interface connectable as a default host to a peripheral or as a default peripheral to a host, for serial data communication between host and peripheral during a session, and comprising: automated means for periodically checking a connection by periodically starting a session when connected as a default host and automated means for periodically checking a connection by periodically requesting a session when connected as a default peripheral.

10 Fig. 1

15

20

